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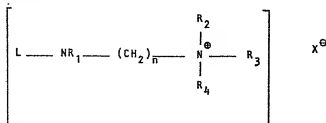
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(64) Improvements in or relating to iodophors.

(57) An iodophor composition comprising a complex of iodine with a quaternary ammonium compound of the general formula I:



wherein L represents an acyl radical derived from lenolin fatty acid, R<sub>1</sub> is hydrogen or a C<sub>1-4</sub> alkyl group, R<sub>2</sub> and R<sub>3</sub> each represent a C<sub>1-4</sub> alkyl group, R<sub>4</sub> is an alkyl, aralkyl, hydroxyalkyl, or unsaturated aliphatic hydrocarbon radical, X is a compatible anion and n is an integer of from 2 to 5, in an aqueous medium, a method for its preparation and a method of disinfecting a locus employing said iodophor composition.

The iodophor compositions are particularly suitable for use as test or udder dips for the prevention or control of bovine mastitis.

IMPROVEMENTS IN OR RELATING TO IODOPHORS

This invention relates to iodophor compositions and, in particular, to iodophor solutions suitable for topical application or iodophor solutions which, in use, come in contact with the skin, and which have inherent emolliency. The iodophor solutions according to the invention are particularly useful as teat dips in mastitis control in cows.

Iodophors are carriers of iodine and are usually complexes of iodine with certain types of surfactants with detergent properties. It is possible for iodine to be taken up in chemical combination by high molecular weight surfactants and water-soluble polymers. The surfactants may be nonionic, cationic or anionic but generally the most efficient and stable iodophors are compounds of nonionic surfactants, such as alkoxy-  
lated compounds having a free terminal hydroxyl group on the alkoxy chain. Though the iodine in an iodophor is held in loose chemical combination, part of the iodine is available and retains its bactericidal activity. Iodophors may solubilise up to 25% by weight of iodine of which 70 to 80% may be released as available iodine when a concentrated solution is diluted.

Solutions of iodophors can be formulated with acid and the bacterial action of most of them is enhanced by lowering the pH. Increases in temperature increase the bactericidal action of iodophors, but above 43°C they break down with the liberation of iodine.

Solutions of iodophors are conventionally employed in pre-operative skin disinfection and for disinfecting instruments and blankets. They are also used in the food industry and in dairy sanitation, in particular, as teat dips for cows.

The use of iodophors has largely replaced the use of steam in the cleansing and sterilisation of work-tops and utensils in the catering and food industries, with consequent savings in energy.

The main disadvantage of known iodophors is that with prolonged use they cause dermatological problems such as cracks or fissures which are thought to result from a loss of the skin's natural protective fats by a process of emulsification.

It will be appreciated that nonionic surfactants are powerful fat emulsifiers and have a degreasing effect on the skin. This problem is particularly prevalent when iodophors are used as teat dips in bovine hygiene.

The earliest iodophor teat dips employed the  
aforementioned alkoxyated compounds as the nonionic  
surfactant complexing agent and were particularly harsh  
on the teat skin. Continued use of such iodophor  
5 preparations resulted in a widespread incidence of teat  
cracking with concomitant risk of infection due to the  
harbouring of bacteria in cracks and fissures in the  
skin of the teats.

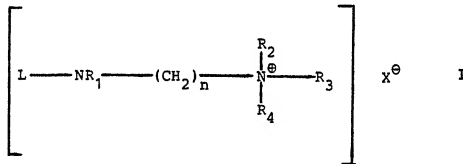
The problem of teat cracking was significantly  
10 reduced with the advent of the iodophors employing  
alkoxyated lanolin as a nonionic surfactant. Such  
iodophors form the subject of British Patent  
Specification No. 1144637. Alkoxyated lanolin,  
especially ethoxyated lanolin, has as an emollient  
15 effect which substantially reduces the incidence of  
teat cracking.

Experiments have shown that no iodine can be  
detected on the udder skin approximately one hour after  
dipping of the udder in a conventional iodophor teat  
20 dip. This loss of iodine can be attributed essentially  
to two factors, the first being a high rate of evapor-  
ation of iodine as the film of iodophor attains body  
temperature and the second being a rapid reduction of  
iodine to iodide in the presence of oxidizable organic  
25 soil. Accordingly, if one uses an iodophor teat dip at the

morning and evening milking sessions, there will be a period between the two sessions of about 7-8 hours during which no active iodine will be present on the teat skin with consequent risk of bacterial infection or reinfection. If such infection occurs whilst the dermal tissues are fissured then mastitis normally results.

It is an object of the present invention to provide an iodophor composition which has inherent emollient activity coupled with bactericidal activity.

Accordingly, the invention provides an iodophor composition comprising a complex of iodine with a quaternary ammonium compound of the general formula I:



wherein L represents an acyl radical derived from lanolin fatty acid,  $\text{R}_1$  is hydrogen or a  $\text{C}_{1-4}$  alkyl group,  $\text{R}_2$  and  $\text{R}_3$  each represents a  $\text{C}_{1-4}$  alkyl group,  $\text{R}_4$  is an alkyl, aralkyl, hydroxyalkyl or unsaturated aliphatic hydrocarbon radical, X is a compatible anion and n is an integer of from 2 to 5, in an aqueous medium.

Preferably, the quaternary ammonium compound (Q.A.C) is a compound of formula I wherein  $R_1$  is hydrogen,  $R_2$  and  $R_3$  independently of each other represent a methyl or an ethyl group,  $R_4$  is a  $C_{1-4}$  alkyl group or an ar( $C_{1-4}$ )alkyl group, X is a compatible anion and  $n = 2$  or 3.

Further, preferably, X is a halide, nitrate, sulphate, alkylsulphate or alkylphosphate anion.

Most preferably, L represents an acyl radical derived from refined lanolin acid.

An especially preferred compound of formula I is one wherein L is an acyl radical derived from a refined lanolin fatty acid,  $R_1$  is hydrogen,  $R_2$  and  $R_4$  are each methyl,  $R_3$  is ethyl,  $n = 3$  and X is an ethylsulphate ion viz lanolinamidopropyldimethylethylammonium ethosulphate.

Commercially available lanolin Q.A.C.'s are primarily used in the cosmetics industry and tend to be made and used in diol (glycol) solution, for example in propylene glycol as described for example in British Patent Specification No. 1590012

It has now been found that iodophor compositions according to the invention can be readily prepared from lanolin Q.A.C.'s in the absence of any diol compound. Thus, lanolinamidopropyldimethylethylammonium ethosulphate per se has been successfully complexed with iodine to form an iodophor composition according to the invention.

Many of the lanolin Q.A.C.'s of formula I which can be complexed with iodine to form the iodophor compositions according to the invention have a consistency which is similar to that of petroleum jelly.

5 With such lanolin Q.A.C.'s it has been found easier to prepare the iodophor composition if the Q.A.C. is used together with a nonionic surfactant. Any commercially available nonionic surfactant is suitable. However, a particularly suitable nonionic surfactant is

10 TEXOPOR V27 (TEXOPOR V27 is a Trade Mark) which is a polyoxyalkylene condensate of a linear fatty alcohol. Other suitable nonionic surfactants are (i) the non-ionics referred to as polyoxyethylene derivatives of sorbitan fatty acid esters or alkyl sorbitan

15 polyoxyethylene marketed under the Trade Marks "Tweens", the most preferred being "Tween 80", also known as polysorbate 80 or sorbitan mono-oleate; and (ii) the nonionics referred to as polyoxyethylene-polyoxypropylene block polymers marketed under the

20 Trade Mark "Pluronics", particularly those having molecular weights ranging from 4,000 to 8,000 with approximately 40-70% of the polyoxyethylene hydrophilic polymer and 60-30%, respectively, of the polyoxypropylene hydrophobic polymer, the most preferred being

25 "Pluronic F127" also known as poloxomer 407.

Preferably, the lanolin Q.A.C.(s) should be used in an amount of 25-50% by weight and the nonionic surfactant in an amount of 50-75% by weight of the lanolin Q.A.C.(s)/surfactant mixture.

Another especially preferred compound of formula I is one wherein  $R_1$  is hydrogen,  $R_2$  and  $R_3$  each represent methyl,  $R_4$  is benzyl,  $n = 3$  and  $X$  is a chloride ion.

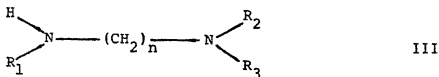
The invention also provides a method for preparing an iodophor composition which comprises forming a complex of iodine with a quaternary ammonium compound of formula I.

Preferably, the iodophor compositions according to the invention have a titratable iodine value in the range of 1.5-2.5% w/w.

The compounds of formula I are known and can be readily prepared by conventional techniques such as by reaction of a lanolin acid of formula II:

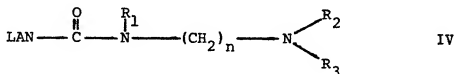


wherein LAN represents the fatty acid side chain of a lanolin acid, with a diamine having the formula III:





wherein  $R_1$  is hydrogen or a  $C_{1-4}$  alkyl group,  $R_2$  and  $R_3$  are  $C_{1-4}$  alkyl groups and  $n$  is an integer from 2 to 5, to form a lanolin amide of formula IV:



5                   The lanolin amide of formula IV is treated with a suitable quaternizing agent such as an aliphatic halide, aralkyl halide, ethylene chlorohydrin or alkylsulphate so as to obtain the corresponding compound of formula I.

10                   Especially preferred quaternizing agents include alkyl halides such as methyl bromide, ethyl iodide or isopropyl bromide, aryl halides, aralkyl halides such as benzyl chloride, alkylsulphates such as dimethyl or diethyl sulphate or ethylene chlorohydrin. However,  
15 any suitable known quaternizing agent can be used.

                  The lanolin acid of formula II may be any commercially available lanolin fatty acid or mixture of such lanolin fatty acids.

                  Representative diamines of formula III for  
20 preparing preferred compounds of formula IV which are then quaternised to form the corresponding compounds of formula I include: dimethylaminopropylamine, diethylaminopropylamine, dimethylaminoethylamine, and diethylaminoethylamine.

The iodophor compositions according to the invention may comprise a mixture of compounds of formula I.

5 The iodophor compositions according to the invention may also include one or more quaternary ammonium halide compound(s) such that the ratio of compounds of formula I to said quaternary ammonium halide compound(s) is not less than 4:1.

10 The iodophor compositions according to the invention will preferably have a total Q.A.C. concentration in the range 0.5-10% by weight, especially 1-5% by weight.

15 The iodophor compositions according to the invention may also include a complex of iodine with a nonionic surfactant in addition to the compound of formula I. Suitably said nonionic surfactant may be an alkoxyated lanolin of the type employed in the iodophor compositions of British Patent Specification No. 1144673, especially an ethoxylated lanolin or an alkoxyated compound having a free hydroxyl group on the alkoxy chain such as ethoxylated octyl phenol or ethoxylated nonyl phenol. However, in the compositions according to the invention the compounds of formula I should represent at least 20% by weight of the total surfactant present. The compound of formula I is preferably mixed with any additional nonionic surfactants used before complexing with iodine.

25 The compounds of formula I have both emollient and

antiseptic properties due to the bifunctional nature of the molecules of the compound of formula I, unlike conventional quaternary ammonium surfactants.

5       The iodophor compositions according to the invention are particularly suitable for use as teat or udder dips (hereinafter referred to as teat dips) for cows for the prevention or control of mastitis.

10       Teat dips according to the invention preferably have an iodine activity or available iodine content of between 0.25-0.75% by weight, especially 0.5% by weight.

      The total Q.A.C. concentration of teat dips according to the invention is preferably in the range 5,000-25,000 p.p.m.

15       The invention further provides a method of disinfecting a locus which comprises applying to said locus an iodophor composition as hereinabove defined.

20       The iodophor compositions according to the invention have superior emolliency to the iodophor compositions based on alkoxylated lanolin described in British Patent Specification No. 1144637.

25       The superior emolliency of the compositions according to the invention is considered to be due to their affinity as quaternary ammonium compounds for the keratin of the skin to which they become strongly bonded as do other quaternary ammonium compounds. Nonionic ethoxylated lanolin for example does not have this property.

As quaternary ammonium compounds, the compounds of formula I have biocidal properties in their own right. Accordingly, it will be appreciated, for example, in the case of a teat dip, that after the iodine content of the iodophor composition has disappeared as described above due to natural evaporation and reduction of iodine to iodide, a film of the quaternary ammonium compound will remain which has both biocidal and emollient properties, thereby extending the protection afforded by the iodophor composition.

The invention will be further illustrated by the following Examples. The Preparations illustrate the preparation of Q.A.C.s for complexing with elemental iodine to form iodophor compositions according to the invention.

#### PREPARATION 1

Lanolinamidopropyldimethylbenzylammonium chloride

(a) Dimethylaminopropyl lanolin acid amide

One mole (about 340 grams) of warm lanolin fatty acids was poured into a flask which was fitted with a stirrer, thermometer, dropping funnel and reflux condenser. The air in the apparatus was displaced with nitrogen and the contents heated within the range 105-115°C.

Over the next 15 to 20 minutes 130 grams (about 1.3 moles) of dimethylaminopropylamine were added dropwise and the temperature increased to 140°C to

150°C. This temperature range was maintained for  
some 7 to 8 hours. During the final 4 hours a vacuum  
was applied which it was possible to reduce to 1 mm Hg  
during the last hour when the temperature was raised to  
160°C.

The reaction mixture was thereafter cooled to  
yield the amide of the original lanolin fatty acids.

(b) Quaterization of the dimethylaminopropyl lanolin  
acid amide

About 200 grams of the dimethylaminopropyl lanolin  
acid amide were placed in a reaction vessel and heated  
to 75°C. At this point 62 grams of benzyl chloride  
were dropped in slowly over a period of 1 hour and the  
mixture was maintained at 110°C for 3 hours. During  
the last hour of the reaction the pressure was reduced  
as before. The mixture was cooled to yield the final  
product - the quaternary ammonium chloride of the  
lanolin fatty acids. The final product had the consis-  
tency of petroleum jelly and the characteristic odour  
of a Q.A.C.. Analysis indicated circa 78% quaternization.

PREPARATION 2

Lanolinamidopropyldimethylethylammonium ethosulphate

Dimethylaminopropyl lanolin amide prepared accord-  
ing to Preparation 1 - step (a) was heated to 75°C in  
a reaction vessel and then an equivalent amount of  
diethylsulphate was added slowly over a period of one  
hour. The temperature was then raised to 110°C and  
maintained at that temperature for 3 hours.

During the last half hour of the reaction the pressure was reduced to 1/mmHg.

The mixture was then cooled. The final product had a consistency of petroleum jelly and the characteristic odour of a Q.A.C. Analysis indicated circa 80% quaternization.

Example 1

The final product of Preparation 1 was mixed with a nonionic surfactant TEXOFOR V27 in a ratio of 1:2.

100 g of the Q.A.C./surfactant mixture was mixed with elemental iodine (11.5 g) and the resultant iodophor diluted to 500 ml with deionised water and filled into 50 ml bottles. The iodophor composition so produced gave a titratable iodine value of 1.8% w/w using thiosulphate.

The iodophor composition was diluted with water to give a solution having an iodine activity or available iodine content of 0.5%, which solution was then used as a teat dip.

The teat dip so prepared was used in routine mastitis control in a dairy herd of 50 animals over a period of 8 weeks at the morning and evening milking sessions. Prior to the trial approximately 50% of the animals had some degree of teat cracking. At the end of the trial no animal who was free of teat cracking

prior to the trial was found to have developed teat cracking. Furthermore, and more importantly, in the case of approximately 75% of those animals who had teat cracking at the beginning of the trial, no teat cracking was evident at the end of the trial. In the remaining animals there was a considerable improvement in the condition of the teats.

EXAMPLE 2

The final product of Preparation 2 (5g) was treated with iodine (2 g) and the resultant iodophor diluted to 100 ml with deionised water and filled into bottles. An iodophor was thereby produced having a titratable iodine content of 1.8%. Before use as a teat dip the iodophor solution was diluted with water so as to give an iodine activity of approximately 5 g per litre.

On dipping with the teat dip so prepared it was found that the quaternary ammonium lanolin compound, which has biocidal activity, was still present on the teats after two hours when the iodine had disappeared due to natural evaporation and also by reduction to iodide by organic soil on the teats, which acts as a powerful oxidant. Accordingly, the quaternary ammonium compound provides continued protection to the skin tissue against infection/reinfection until the next milking session.

EXAMPLE 3

A teat dip was prepared from the following ingredients:

	Concentration
	<u>(%w/w)</u>
5 Lanolinamidopropyldimethyl- ethyl ammonium ethosulphate (Product of Preparation 2)	5.0
TEXOFOR V27	10.00
10 Iodine	2.1
Water	82.80

Activity: 25,000 p.p.m. Q.A.C.; 18,600 p.p.m.  
available iodine.

15 The concentration solution (1 part) was then  
diluted with water (2 parts) to prepare a teat dip  
ready for use.

Activity  
of teat dip: 8,333 p.p.m. Q.A.C.; 6,170 p.p.m.  
available iodine.

20 The teat dip was found to be stable for at least  
24 hours in an open container.



EXAMPLE 4

A teat dip was prepared from the following ingredients:

	Concentration
	<u>(% w/w)</u>
5      Lanolinamidopropyldimethyl-	
benzylammonium chloride	5.0
(Product of Preparation 1)	
TEXOPOR V27	10.00
10     Iodine	2.1
Water	82.9

The concentrated solution (1 part) was then diluted with water (2 parts) to prepare a teat dip ready for use.

15      Activity

of teat dip: 16,600 p.p.m. Q.A.C.; 6,170 p.p.m. available iodine.

EXAMPLE 5

A teat dip was prepared from the following ingredients:

5		Concentration <u>(% w/w)</u>
	Lanolinamidopropyldimethyl- ethylammonium ethosulphate (Product of Preparation 2)	2.5
	Empigen BAC*	0.5
10	TEXOFOR V27	10.0
	Iodine	2.1
	Water	81.9

\*BAC = Benzalkonium chloride (Empigen BAC is a Trade Mark)

15           The concentrated solution (1 part) was then diluted with water (2 parts) to prepare a teat dip ready for use.

Activity

of teat dip: 10,000 p.p.m. Q.A.C.; 6,170 p.p.m.  
available iodine

BACTERICIDAL EFFICIENCY OF LANOLINAMIDOPROPYLDIMETHYL-  
ETHYLAMMONIUM ETHOSULPHATE CONTAINING IODOPHOR  
TEAT DIP AGAINST STAPHYLOCOCCUS AUREUS (NCTC 6571) ON  
EXCISED COWS' TEATS

5           Laboratory tests were carried out to demonstrate  
that the lanolinamidopropyl dimethylethylammonium  
ethosulphate containing iodophor teat dip would exert  
bactericidal activity on cows' teats 15 hours after  
application.

METHODS

10           For convenience excised cows' teats were used in  
preference to working with live animals. The teats  
were collected from recently slaughtered cows and  
prepared by the method recommended by Philpot et al  
(1978) J. Dairy Sci 61: 950-955. The teats were frozen  
15 in plastic bags in lots of 10 and thawed immediately  
prior to the commencement of the experiment.

The stock culture of Staphylococcus aureus (NCTC  
6571) was grown in Brain Heart Infusion Broth (Oxoid)  
incubated at 37°C for 18 hours. The suspension con-  
20 tained  $4.1 \times 10^9$  colony forming units (cfu) per  
millilitre.

The iodophor preparation used contained:

5.0% Lanolinamidopropyl dimethylethylammonium  
ethosulphate

25           10.0% Synperonic NP9 (Synperonic NP9 is a Trade Mark)  
2.1% Iodine (available Iodine 1.85%)

At the start of the experiment 32 arbitrarily selected teats were suspended on stainless steel hooks from elevated metal rods (16 test and 16 control teats). The selection of test and control teats was statistically randomised. The teat dip preparation was applied to each of the test teats by immersion to a depth of approximately 4cm. Control teats were similarly exposed to distilled water. The teats were maintained at ambient temperatures ( $21 \pm 2^{\circ}\text{C}$ ) for a period of 15 hours.

At the end of this time period each teat was momentarily dipped to a depth of 2.5cm in the stock Staphylococcus culture. The teats were allowed to dry for a period of 45 minutes. At the end of this time each teat was swabbed for 25 seconds with a neutralising solution of 8% (w/v) Sodium thiosulphate, 0.5% v/v Tween 80 and 0.5 (v/v) lecithin. This swab was discarded. A second swab, moistened in the neutralizing solution, was then rubbed over the lower 1.5cm of each teat for a period of 20 seconds. After use the swabs were snapped off into separate 4ml aliquots of a solution of 0.1% (v/v) thiosulphate, 0.1% (v/v) Tween 80 and 0.1% (v/v) lecithin in Universal bottles.

The swabs in neutralising solution were immediately shaken at a constant high speed for a period of 5 minutes on a Stuart Flask Shaker. Decimal dilutions were prepared for each swab/neutraliser sample. Pour plates were prepared over a range of dilutions using Blood Agar Base No. 2 (Oxoid) supplemented with 7% Bovine serum (Oxoid) as the culture medium. After incubation at 37°C for 18 hours the number of Staphylococcus colonies was determined by direct counting.

## RESULTS

	Mean Count of <u>S aureus</u> recovered (cfu per ml)
Control	$6.59 \times 10^6 \pm 3.3 \times 10^6^*$
Iodophor containing lanolinamido- propyldimethylethyl- ammonium ethosulphate	39.4 66.5*

\*Standard Deviation.

The results show that 15 hours after application the lanolinamidopropyldimethylethylammonium ethosulphate containing iodophor preparation still shows good bactericidal properties against Staphylococcus aureus giving greater than log 5 reduction in this test situation.

BACTERICIDAL EFFICIENCY OF LANOLINAMIDOPROPYLDIMETHYL-  
ETHYLAMMONIUM ETHOSULPHATE CONTAINING IODOPHOR TEST DIP

Laboratory tests were carried out to determine the  
bactericidal efficiency of a Lanolinamidopropyldimethyl-  
ethylammonium ethosulphate containing iodophor test dip  
against the following bacteria:-

- |                                    |                                  |
|------------------------------------|----------------------------------|
| 1. <u>Staphylococcus aureus</u>    | NCTC 6571                        |
| 2. <u>Escherichia coli</u>         | NCTC 10418                       |
| 3. <u>Pseudomonas aeruginosa</u>   | NCTC 10662                       |
| 4. <u>Streptococcus agalactiae</u> | Fermentation<br>type IV (V.R.L.) |

METHOD

Stock cultures of the bacteria were grown in Brain  
Heart Infusion broth (Oxoid) incubated at 37°C for 18  
hours. The stock cultures were diluted to give working  
suspensions containing approximately  $10^8$  cells per  
ml.

Bacterial concentrations of working suspensions  
and numbers of surviving bacteria after trial were  
estimated by culturing on Blood Agar Base No 2 (Oxoid)  
supplemented with 7% Bovine serum (Oxoid). Trials were  
carried out in sterile test-tubes at a temperature of  
37°C. Testing was carried out as follows:

Bacterial Suspensions were treated with the  
lanolinamidopropyldimethylethylammonium etho-  
sulphate containing iodophor for a period of  
16 hours after which time the preparations  
were neutralised.

Inactivation of disinfectant after the required contact time was achieved using a neutralizing solution containing 2.0% Lecithin, 2.0% Tween 80, 0.5% Sodium thiosulphate and 0.1% peptone.

5           The results are shown in Table 1.

The results show that the lanolinamidopropyl-dimethylethylammonium ethosulphate containing iodophor teat dip has excellent bactericidal activity against the bacteria tested.

10           The trial shows that the lanolinamidopropyl-dimethylethylammonium ethosulphate containing iodophor teat dip gives a better than required kill even at low concentration (0.5% lanolinamidopropyl-dimethylethylammonium ethosulphate; 0.25%  $I_2$ )

Table 1

Concentration	<u>Staphylococcus</u>	<u>Escherichia</u>	<u>Pseudomonas</u>	<u>Streptococcus</u>
Lanolinamidopropyl-dimethyl-	<u>aureus</u>	<u>coli</u>	<u>aeruginosa</u>	<u>agalactiae</u>
ethylammonium ethosulphate				
& Iodine				
(Q.A.C.) (I <sub>2</sub> )				
0.5% 0.25%	6.58	8.06	8.51	6.81
2.5% 0.25%	6.58	8.06	8.51	6.81



It should be noted that the quaternary ammonium lanolin derivatives used in the iodophor compositions according to the invention are quite different to quaternary ammonium compounds conventionally used in teat dips such as the quaternary ammonium compounds used in the teat dips of the Applicant's British Patent Specification No. 1554615.

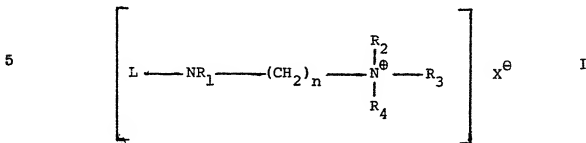
As a comparison, if iodine is complexed with quaternary ammonium compounds of the kind used in the teat dips of British Patent Specification No. 1554615, the teat dip formed from such an iodophor will lose its iodine in the normal way within approximately 1 hour, leaving behind a surfactant film containing a quaternary ammonium compound having no lanolin moiety a part of its structure. Accordingly, such a teat dip will be harsh and have a degreasing action on the skin. Furthermore, the quaternary ammonium compounds will bind to the skin causing irritation even in the presence of ethoxylated lanolin which does not bind to the skin.

Apart from their use as teat dips in the dairy industry, the iodophor compositions according to the invention can also be readily used in skin care; as a pre-operative scrub for surgeons' hands; as a pre-operative wash for human skin prior to surgical procedures; and as an active ingredient in anti-dandruff shampoos. A further use for the iodophor

compositions according to the invention would be as a prophylactic measure in swimming pools and leisure centres against transmission of foot infections caused by fungal or viral types of organisms, for example verrucae.

CLAIMS;-

1. An iodophor composition comprising a complex of iodine with a quaternary ammonium compound of the general formula I:



wherein L represents an acyl radical derived from lanolin fatty acid,  $\text{R}_1$  is hydrogen or a  $\text{C}_{1-4}$  alkyl group,  $\text{R}_2$  and  $\text{R}_3$  each represents a  $\text{C}_{1-4}$  alkyl group,  $\text{R}_4$  is an alkyl, aralkyl, hydroxyalkyl or unsaturated aliphatic hydrocarbon radical, X is a compatible anion and n is an integer of from 2 to 5, in an aqueous medium.

2. An iodophor composition according to claim 1, wherein in the compound of formula I  $\text{R}_1$  is hydrogen,  $\text{R}_2$  and  $\text{R}_3$  independently of each other represent a methyl or ethyl group,  $\text{R}_4$  is a  $\text{C}_{1-4}$  alkyl group or an ar( $\text{C}_{1-4}$ )alkyl group, X is a compatible anion and n is 2 or 3.

3. An iodophor composition according to claim 1 or 2, wherein in the compound of formula I X is a halide, especially chloride, nitrate, sulphate, alkylsulphate, especially ethylsulphate, or alkylphosphate anion and L represents an acyl radical derived from refined lanolin acid.
4. An iodophor composition according to claim 1, which contains a mixture of compounds of formula I complexed with iodine.
- 10 5. An iodophor composition according to any preceding claim, which has a titratable iodine value in the range of 1.5-2.5% w/w.
6. An iodophor composition according to any preceding claim, which includes one or more quaternary ammonium halide compound(s) such that the ratio of compounds of formula I to said quaternary ammonium halide compound(s) is not less than 4:1.
- 15 7. An iodophor composition according to any preceding claim, which contains a total concentration of quaternary ammonium compound(s) in the range 0.5-10% by weight.
- 20 8. An iodophor composition according to any preceding claim, which also includes a complex of iodine with a nonionic surfactant, especially an

alkoxylated lanolin, an ethoxylated octyl phenol or ethoxylated nonyl phenol or a mixture of said phenols, in an amount of up to 80% of the total surfactant present.

- 5     9. An iodophor composition according to any one of the preceding claims, which is in the form of a teat dip and which has an available iodine content in the range 0.25-0.75% by weight and a total Q.A.C. concentration of 5,000 - 25,000 p.p.m.
- 10    10. A method of disinfecting a locus which comprises applying to said locus an iodophor composition according to any one of claims 1-9.
11. A method of controlling mastitis in cows which comprises applying to the teats of an animal a composition according to claim 9.
- 15    12. A method of preparing an iodophor composition according to any one of claims 1-9, which comprises forming a complex of iodine with a quaternary ammonium compound of formula I.
- 20    13. A method according to claim 12, wherein the quaternary ammonium compound is mixed with a nonionic surfactant, especially a polyoxyalkylene condensate of a linear fatty alcohol, prior to complexing with iodine.



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
D,A	GB-A-1 144 637 (KILCO CHEMICALS) * Claims *	5,8,10 ,11	A 01 N 59/12 A 61 K 9/22 (A 01 N 59/12 A 01 N 37/20 ) //
A	GB-A-1 441 364 (DIVERSEY LTD.) * Page 1, line 89 - page 2, line 9; example; claims *	5,8,10 ,11	
A	US-A-4 113 857 (B.V. SHETTY) * Column 7, lines 48-68; claims 1,9 *	1,4,5, 10	
D,A	US-A-4 069 347 (J.P. MCCARTHY et al.) * Example 9; claims 1,2 *	1-3	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 7)
			A 01 N A 61 K
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 05-08-1983	Examiner FLETCHER A.S.
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		& : member of the same patent family, corresponding document	